

## GENERAL INFORMATION

### INSTALLATION

Installation must be performed per FAA Advisory Circular 43.13-1B or later FAA approved revision.

### PROBE AND LEAD WIRE

Install probes and lead wires per their respective installation instructions, which are enclosed in applicable package, prior to installing the indicator.

- EGT Probe Instructions 59180 and EGT Lead Instructions 59181
- CHT Probe Instructions 59188 and CHT Lead Instructions 59181

### PROBE LOCATION

Probe location for single probe EGT systems should be 2" to 4" from the exhaust flange, in a cylinder that is determined to be the best representative of the leanest cylinder, or the engine as a whole. Because each engine is unique, this is a major shortcoming of single probe systems. Neither *Alcor*® nor the engine manufacturer can guarantee which cylinder is the leanest and therefore, determination of which cylinder to place the probe in, in a single probe EGT system, is left entirely up to the installer or to the aircraft owner.

### CALIBRATION AND LEAD WIRE LENGTH

Even though most EGT scales are not numbered, they are calibrated to true temperature. (Usually 1200°F to 1700°F). CHT meters are numbered and calibrated accordingly. Indicators are calibrated for precision at 1600°F for EGT's, 1650°F for TIT's, and 500°F for CHT's. The single indicators and dual combination indicators (i.e. CHT/EGT or any other combination) are calibrated for 90" lead wires. The dual indicators (both EGT and TIT) are calibrated for 216" lead wires. All CHT leads are manufactured to 8 regardless of lead lengths by adding a resistor. If any other temperature calibration or any other lead wire length is used, then the indicator will have to be recalibrated as part of the installation. EGT indicators can be recalibrated with either an *Alcal*® EGT System Tester or by following the procedures in the In-Flight Systems Calibration Section. CHT and TIT indicators can only be recalibrated with an *Alcal*® CHT or EGT (TIT) System Tester, or equivalent, or returned to *Alcor*® for free recalibration.

### LOCATION

Determine a location for the indicator in the instrument panel that is convenient for the pilot to observe when operating the mixture control. Ensure there is adequate clearance for indicator behind instrument panel, clear of controls, other instruments, etc.

### WIRING

*Alcor*® indicators will operate properly only when used with *Alcor*® designed probe(s) and lead wire(s). When connecting wires, match color code on the indicator placard (red/yellow for EGT and TIT; black/yellow for CHT). Connect the lead wires as shown in **Figure 1**, observing color coding Red to Red, Yellow to Yellow, Black to Black. Do not use the terminal(s) marked "UCS Use Only" which is (are) optional TIT for analyzer conversion only.

**IMPORTANT: EGT systems and components with Red/Brown color code are not compatible with systems and components using Red/Yellow color codes.**

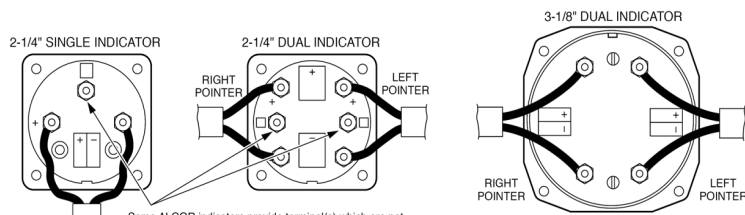


FIGURE 1 - LEAD WIRE CONNECTIONS (Rear View of Indicator)

**MOUNTING:** Secure the indicator in appropriate 2-1/4" or 3-1/8" opening in the instrument panel from the rear with the hardware provided (can also be mounted from the front).

**WEIGHT:** Single, 0.2 lbs.; Dual 0.4 lbs. (without lead(s) and probe(s))

**SYSTEM CHECK:** After installation, conduct a calibration or functional check on the system as follows:

### EGT

- (a.) Calibration check: Use *Alcal*® EGT System Tester (see *Alcal*® Operators Manual).
- or (b.) Functional check: Run aircraft engine at normal run-up R.P.M. Lean engine until you observe pointer movement,
- or (c.) Initial In-flight calibration: After a functional check, EGT system can be calibrated (fine tuned) to the engine/aircraft on the initial flight (and any subsequent flights) see In-Flight System Calibration Section.

### CHT & TIT

- (a.) Calibration check: Indicators factory calibrated by *Alcor*® should not need calibration. To verify accuracy, use *Alcal*® System Tester to perform system calibration (see *Alcal*® Operators Manual).
- or (b.) Functional check: Run aircraft engine at normal run-up R.P.M. Lean engine until you observe pointer movement.

**CAUTION: If CHT or TIT pointer does not move, the system must be made operational before flight, if required instrumentation per the aircraft's minimum equipment list.**

Should the system not work correctly, see Troubleshooting Section in these instructions.

**IN-FLIGHT SYSTEM CALIBRATION:** In-flight system calibration allows you to "fine tune" the indicator to the engine. Relative reading systems can be calibrated in-flight. Calibration begins with establishing the altitude which allows cruise power (65%) at full throttle operation. (For turbo supercharged engines with automatic wastegate control, use an altitude of about 6000 or 7000 ft. above sea level and establish 65% power). Calibrate indicator so that "peak EGT" occurs at the asterisk (\*) or 4/5 scale as follows:

- Step 1.** Lean mixture slow enough for pointer to follow.
- Step 2.** EGT will first increase and then decrease. The point of maximum deflection is "Peak EGT". Adjust mixture to "Peak EGT".
- Step 3.** Use the calibration screw (see **Figure 2**) on front of EGT to adjust the needle to the asterisk (\*), with the *Alcor*® screwdriver provided.

*NOTE: This becomes the reference temperature for desired mixture control. The EGT is now calibrated.*

**CAUTION: Two important guidelines that should normally be observed when setting mixture control based on EGT are:**

- 1. Avoid leaning the mixture to "Peak EGT" above normal cruise power setting.**
- 2. Never exceed TIT or CHT limitations - they limit EGT. (Sometimes it will be necessary to operate rich of peak in order to keep CHT or TIT within safe limits.)**

Recheck reference temperature from time to time but only at the same power and altitude determined above. A check within +/- 25°F, one small division, or +/- 1-1/2% is considered good. EGT readings may change slightly with time due to exhaust deposit build-up on the probe, or internal resistance changes. EGT readings will change with power, altitude, and OAT changes.

There is no in-flight calibration for CHT or TIT. All calibration is done by *Alcor*® or with an *Alcal*®. Do not adjust CHT or TIT calibration screw unless you have the proper calibration equipment.

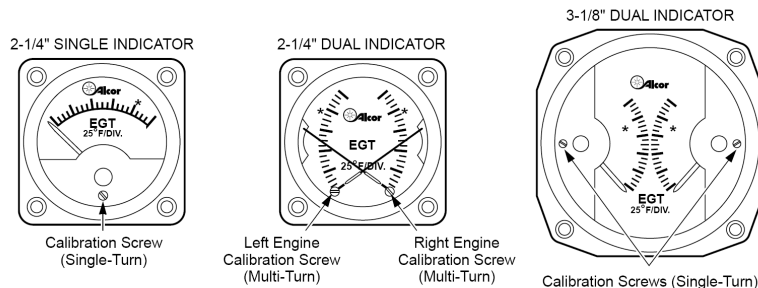


FIGURE 2. - CALIBRATION SCREW LOCATION (Front View of Indicator)

**SYSTEM OPERATION:** Instructions and limitations set forth in Airplane Flight/Operation Manual and engine manufacturer's bulletins (Continental M89-18; Lycoming 1094D) are the basis for these instructions.

**EGT SYSTEM:** "Peak EGT" is the key to the EGT method of mixture control. The EGT System is designed to help provide more economical flight and identify engine malfunctions. The desired fuel-air mixture for maximum range at cruise power, up to 65%, is determined by observing "Peak EGT" as presented on the indicator. A probe, positioned in the exhaust port near the exhaust valve, senses the exhaust gas temperature and generates electricity (thousandths of a volt). The EGT indicator measures this voltage and the pointer moves to indicate the exhaust gas temperature which is read by the pilot. At full rich mixture excess fuel is not burned and results in a lower combustion temperature. As the mixture is leaned, the amount of excess fuel is reduced and the exhaust gas temperature increases. At the point where there is complete burning of the fuel and air mixture "Peak EGT" exists (no excess fuel or air). "Peak EGT" is observed noting indicated temperature starting to drop as the mixture is being leaned. Lean of "Peak EGT" results in excess air after combustion and it also results in a lower exhaust gas temperature. EGT Systems are generally calibrated so that at cruise power, "Peak EGT" will occur near the asterisk (\*), used as a reference (see In-Flight System Calibration Section these instructions).

**TAKEOFF AND CLIMB (after calibration):** For normally aspirated engines at full rich/full power, the normal EGT is at least 100°F below (rich) reference temperature, (\*). For highly supercharged engines such as IGSO-540, about 150°F to 200°F below reference temperature is normal.

Let Cylinder Head Temperature and/or Turbine Inlet Temperature dictate; i.e., enrich mixture and/or increased airspeed to keep CHT and/or TIT within limits, preferably not over 400°F (or red line when applicable) for CHT, and not over 1650°F (or red line when applicable) for TIT. See Airplane Flight Manual for specific temperature limits.

**CRUISE:** For cruise flight, determine "Peak EGT" for each flight, and for any change in flight conditions (altitude and power setting). Establish desired cruise altitude and power. Identify "Peak EGT" by observing where the indicator peaks while leaning. Then enrich the EGT by 50° to 100°F. This is intended to keep any unmonitored cylinder from operating lean of peak. Operation of any cylinder on the lean side of its peak should be avoided.

*NOTE: Single probe EGT systems can sense EGT for only one cylinder. Since different cylinders may become the "leanest cylinder" as flight conditions change, the EGT indicator may not be monitoring the temperature of the leanest cylinder. Therefore, the EGT is enriched by a safety factor of 50 to 100°F in case there is a cylinder that is leaner than the cylinder being monitored. Combustion Analyzer systems (systems providing probes in all cylinders) allow monitoring of all cylinders, permitting operation of the leanest cylinder up to "peak EGT". This provides a substantial fuel savings (1 to 2 gallons per hour) in addition to allowing engine malfunctions to be identified in their early stages.*

### DESCENT

1. Enrich mixture to drop EGT about 50°F below cruise temperature before reducing power.
2. While descending, continue to enrich mixture to keep EGT at peak or 50°F below (rich of) peak.
3. During prolonged descent, maintain sufficient power to keep EGT 50°F to 100°F below (rich of) peak for cruise. This will assist in keeping engine(s) temperature above minimums and prevent over-cooling.

### LIMITATIONS

1. NEVER LEAN THE MIXTURE TO "PEAK EGT" ABOVE NORMAL CRUISE POWER SETTINGS.
2. NEVER EXCEED TIT OR CHT LIMITATIONS - (See your Airplane's Flight Manual.) Sometimes it will be necessary to operate rich of "Peak EGT" in order to keep CHT and TIT within safe limits.

**CHT SYSTEM:** The CHT System will provide indications to prevent engine damage due to exceeding Cylinder Head Temperature limitations and can assist the pilot in detecting engine malfunctions and prevent shock cooling of the cylinders.

**CAUTION: CHT SHOULD NEVER EXCEED LIMITATIONS in Airplane Flight/Operations Manual.**

**TIT SYSTEM:** The TIT system provides indication to prevent engine damage due to exceeding Turbine Inlet Temperature limitations.

**CAUTION: TIT SHOULD NEVER EXCEED LIMITATIONS in Airplane Flight/Operations Manual.**

Whenever a system is in question as to its proper functioning, it should be checked with an *Alcor*® EGT (TIT) or CHT System Tester.

Refer to *Alcor*®'s "EGT AND COMBUSTION ANALYSIS IN A NUTSHELL" for further information on EGT mixture control and combustion analysis.

**FAA-PMA/STC SA 522 SW:** This product is FAA approved for installation on **ALL** piston engine aircraft. After installation of complete system, return aircraft to service via Form 337 referencing STC SA 522 SW (see below). This is not required for replacement parts. All piston powered aircraft, regardless of make, are covered by this STC.

**TROUBLESHOOTING:**

If the indicator pointer does not move as intended, check the following:

- Check the connections between the probe and lead wire and between the lead wire and indicator. They should be clean and tight.
- Make certain there are no shorts between two connectors, or from any conductor to airframe ground. **Alcor**® probes are grounded at the probe tip.
- Check continuity of circuit from probe to indicator. For EGT/TIT the red lead wire should be continuous from probe to indicator (same for yellow lead). For CHT the black wire should be continuous from the probe to the indicator (same for yellow). There should be no open connections or breaks in the wires.
- System can be checked for correct wiring by inputting a millivolt signal (using an **Alcal**®) or heating probe (propane torch for EGT and TIT, cigarette lighter for CHT) and observing indicator pointer movement.
- Probe loop resistance should be approximately 0.8 ohms for EGT, and .24 ohms for CHT. Ensure reading is not erratic when wiggling probe wire back and forth.
- If pointer seems to stick, bind or jump (movement friction, foreign material, or pointer hits glass or dial), then return indicator to **Alcor**® for repair.
- Check probe, lead and indicator polarity by reversing lead connections at indicator end, then at probe. If pointer moves, the polarity is reversed, therefore, return probe, lead and/or indicator (whichever one(s) with reversed polarity) to place of purchase or to Alcor®. Red = Negative
- Off scale readings (high) can be caused by an inducted voltage - make sure leads are isolated from high voltage sources such as alternators and strobe lights.

# EGT/CHT Indicators

## Installation Instructions

FAA/PMA Approved

Web site: [www.alcorinc.com](http://www.alcorinc.com)  
E-Mail: [support@alcorinc.com](mailto:support@alcorinc.com)

United States Of America  
Department of Transportation - Federal Aviation Administration

## Supplemental Type Certificate

*Number* SA522SW

*This Certificate issued to* Alcor, Inc.  
300 Breesport St.  
San Antonio, TX 78216

*certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 23 of the Federal Aviation Regulations. Parts 3, 4a, 4b of the Civil Air Regulations*

*Original Product Type Certificate Number:* See Limitations and Conditions  
*Make:* See Limitations and Conditions  
*Model:* See Limitations and Conditions

*Description of Type Design Change:*  
Installation of Exhaust Gas Temperature (EGT), Cylinder Head temperature (CHT) Components/Systems in accordance with Master Drawing List titled "Alcor Master Drawing List for STC SA522SW dated November 14, 1984," or later FAA approved revisions.

*Limitations and Conditions:*  
All aircraft equipped with reciprocating engines are eligible for the installation of the Alcor EGT and CHT Component/Systems.

Compatibility of this modification with previously installed equipment must be determined by installer. If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

*This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.*

*Date of application:* April 15, 1965      *Date issued:* 07/05/94; 9/30/02  
*Date of issuance:* May 26, 1965      *Date amended:* April 30, 1992 Rev. 15

*By direction of the Administrator*

S. Frances Cox, Manager  
Special Certification Office,  
Southwest Region

(Title)

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.  
FAA Form 8110-2(10-68) Page 1 of 2      This certificate may be transferred in accordance with FAR 21.47.

### WARRANTY INFORMATION

**Please refer to Alcor's® website, call, or e-mail for troubleshooting tips before returning a possibly defective product to Alcor®.**

Alcor® Inc., warrants all parts in your new **Alcor**® product to be free from defects in material and workmanship under normal use. Our obligation under this warranty is limited to repair or exchange of any defective part of this unit if the part is returned, transportation prepaid, within **THREE YEARS** from the date of manufacture. The replacement parts carry a warranty for the balance of the period of warranty.

Under this warranty, **Alcor**® is not responsible for any service charges, including removal and reinstallation or any other consequential damages.

This warranty is void on any product which has been subjected to misuse, accident, negligent damage, repaired by anyone other than the **Alcor**® Repair Department, or damaged in transit handling. If in the opinion of **Alcor**®, the product's serial number or inspection date label have been altered or defaced, the warranty is void.

This warranty is in lieu of all other warranties expressed or implied and all other obligations of liability on **Alcor**'s® part, and it neither assumes nor authorizes any other person to assume for **Alcor**® any other liability in connection with the sale of **Alcor**® products.

Should the product covered by this warranty fail to operate properly contact Alcor® Customer Support at  
**1/800-FLI-SAFE (1/800-354-7233) or [support@alcorinc.com](mailto:support@alcorinc.com)**

## Take a Flight to Our Web Site

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